

Using Order of Operations

IN THIS LESSON, YOU WILL LEARN

To use the order of operations to simplify mathematical expressions

WORDS TO LEARN

Order of operations rules for performing mathematical operations in expressions having more than one operation

Mathematical expression a combination of numbers and symbols

Mark called a plumber to fix the kitchen sink. When the plumber finished her work, she wrote on the bill, "Labor: $\$45 + 2 \cdot \35 ." Before the plumber could enter the total, Mark said to his brother, Philip, "She's charging us $\$1,645$ for labor!" Philip said, "No, she's charging us $\$115$." Who is correct, Mark or Philip?

New Idea

Mathematicians agree to do mathematical operations in a certain order to simplify mathematical expressions. The rules that describe the order are called rules for the **order of operations** (AWR-duhr uhv ahp-uh-AY-shuhn). The order of operations tells you to always multiply or divide first, working from left to right. Then, add or subtract, working from left to right.

A **mathematical expression** (math-uh-MAT-ih-kuhl eks-PREHSH-uhn) is a combination of numbers and symbols, such as $45 + 2 \cdot 35$. To simplify, or perform all the operations in the expression, follow the order of operations.

Examples: Simplify this mathematical expression. $45 + 2 \cdot 35$

$$45 + 2 \cdot 35 \quad \leftarrow \text{First multiply.}$$

$$45 + 70 \quad \leftarrow \text{Then, add.}$$

$$115$$

Philip was right. The plumber charged $\$115$.

Simplify this mathematical expression.

$$3 + 12 \div 6 + 8 \cdot 3$$

$$3 + 12 \div 6 + 8 \cdot 3 \quad \leftarrow \text{First multiply and divide.}$$

$$3 + 2 + 24 \quad \leftarrow \text{Then, add.}$$

$$29$$

#4
182

Practice

1.4

Name _____

#4
282

In Exercises 1–14, evaluate the expression without using a calculator.

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|----------------------------------|-----------------------------------|
| 1. $3 + 8 \div 2$ | 2. $18 - 6 \div 2$ |
| 3. $4 \cdot 3 + 4^2$ | 4. $6^2 - 9 \cdot 4$ |
| 5. $(3 + 2) \div 5 \cdot 2^3$ | 6. $30 - 3^2 + 4 \cdot 5$ |
| 7. $3[2^4 \div 4 - 2]$ | 8. $16 \div 8(2) \times 6$ |
| 9. $24 + 4^2 \cdot 6$ | 10. $64 \div (2)(8) + 12$ |
| 11. $[2 + 3(2) + 3^2] - 4^2$ | 12. $(4 + 6) \div 2 + 5^2$ |
| 13. $24 + (3^2 \div 3) \cdot 11$ | 14. $[(4^2 + 2) \div 2 + 10] - 2$ |

In Exercises 15–22, use a calculator to evaluate the expression.

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| 15. $36 + 3 \div 12 + 6$ | 16. $12 - 3^2 + 9 \cdot 6$ |
| 17. $100 \cdot 5 \div 5^3$ | 18. $20 - (2^5 \div 4^2) \cdot 6$ |
| 19. $50 - (2 \div 5^2) \cdot 100$ | 20. $75 + 5^3 - 4^3 \div 2^3$ |
| 21. $24 + (2 \cdot 8)^2 \div 4^2 - 6$ | 22. $18 \cdot 2^3 - 5 \cdot 6 \div 2$ |

In Exercises 23–30, decide whether the number sentence is true or false according to the established order of operations. If it is false, insert parentheses to make it true.

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| 23. $4 + 24 \div 6 = 8$ | 24. $18 - 6 \div 2 = 6$ |
| 25. $6 \cdot 3 - 2 \cdot 3 = 18$ | 26. $24 - 3 \div 7 + 2 = 5$ |
| 27. $5 + 2^2 \div 3 = 3$ | 28. $8^2 - 4 \div 2 + 2 = 64$ |
| 29. $24 \div 4 + 2 - 2^2 = 0$ | 30. $4^2 - 3^2 \div 3 = 13$ |

In Exercises 31–34, write a numerical expression for the phrase. Then evaluate your expression.

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| 31. 36 divided by the sum of 9 and 3 | 32. 6 added to the quotient of 42 and 21 |
| 33. 42 divided by the quotient of 14 and 2 | 34. 12 minus the product of 4 and 2 |
35. You and three friends go to the movies. The group has \$40 total. The cost per ticket is \$5.25. Each one of the group wants a large soda for \$1.25 each, and a box of candy for \$1.15 each. Two of the four are willing to share a large buttered popcorn for \$3.75 and the other two are going to share a medium unbuttered popcorn for \$3.00. Write an expression that represents the total. How much money did the group spend? How much money remains?